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REVISION OF THE GENUS *STERNOSTOMA* BERLESE AND TROUESSART[1]

(Acarina: Rhinonyssidae)

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THE GENUS *Sternostoma* Berlese and Trouessart, 1889, is composed of mites parasitic in the nasal cavities of birds. The parasites' primary habitat is the region of the mucous membrane-covered turbinates although they are often found in the anterior nares and even in the larynx and trachea. The mites are sluggish organisms that move slowly on and in the mucous of the cavities. The majority is collected well engorged with blood of the host.

The genus is closely related to *Rhinonyssus* Trouessart, 1894, and indeed the two genera were considered by Zumpt and Till (1955)[3] and Pereira and de Castro (1949) to be the same—an opinion not shared here.

The genus *Sternostoma* was erected by Berlese and Trouessart (1889) to accommodate the species *S. cryptorhynchum*. Trouessart (1895) proposed the name *Sternostomum* as an emendation of the earlier *Sternostoma,* and added the species *Sternostomum rhinolethrum*. *Sternostoma,* having priority, remains the valid name. De Castro (1948) and Strandtmann (1951) demonstrated that *S. rhinolethrum* belongs in the genus *Rhinonyssus* as described by Trouessart (1894).

Vitzthum (1935) and Bregetova (1950, 1951) distinguish between *Sternostoma* with two dorsal plates and *Sternostomum* with one dorsal plate. Under this interpretation, *Sternostomum* would include some species from *Sternostoma* and some from *Rhinonyssus*. This viewpoint does not seem tenable since the dorsal plates are obviously regressing in these mites and do not represent a stable characteristic.

De Castro (1948) and Pereira and de Castro (1949) recognize, as subgenera, *Rhinonyssus* with one dorsal plate and *Sternostoma* with two dorsal plates, and include both in the genus *Rhinonyssus*. Here, again, too great a stress has been placed on the number of dorsal plates.

Zumpt and Till (1955) agree with de Castro and Pereira, but, pointing out that the name *Sternostoma* has priority over *Rhinonyssus,* use the former generic name.

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[3] See "Literature Cited" for citations, referred to in the text by author and date.

For reasons given below, the writer agrees with Strandtmann (1951) in considering *Sternostoma* and *Rhinonyssus* distinct genera.

As the generic name implies, *Sternostoma* species have the mouth parts ventrally located, only the tips being visible from the dorsal side. In *Rhinonyssus,* the gnathosoma is largely visible from above in normal specimens. Some apparent discrepancies, as in the figures by Terzi of *R. caledonicus* and *R. waterstoni,* published by Hirst (1921), are probably a result of the orientation of the specimens on the slides from which the illustrations were made. As pointed out by Strandtmann (*in litt.*), the base of the capitulum is relatively elongate in *Rhinonyssus,* exceeding the length of the movable palpal segments. It is in part due to this elongation of the basis capituli that the mouth parts of *Rhinonyssus* appear characteristically different from those of *Sternostoma.* The claws of tarsus I of *Sternostoma* are greatly reduced and modified as compared with those of *Rhinonyssus. Sternostoma* has an indistinct to well-defined sternal plate, a structure almost or entirely lacking in *Rhinonyssus.* Species of *Sternostoma* seen by the writer have chelicerae with digits not more than $\frac{1}{10}$ the length of the chelicerae, whereas, in *Rhinonyssus,* the digit size apparently is over $\frac{1}{10}$ the cheliceral length.

Sternostoma Berlese and Trouessart

Sternostoma Berlese and Trouessart, 1889, Bibl. Sci. Ouest Bul. **2**(2):128; Vitzthum, 1935, Jour. Ornithol. **83**(4):568, 571; Cooreman, 1946, Bul. Mus. Roy. Hist. Nat. [Belg.] **22**(9):4; de Castro, 1948, Arch. Inst. Biol. Sao Paulo **18**(13):257; Pereira and de Castro, 1949, *ibid.* **19**(15):233; Zumpt and Patterson, 1951, Jour. Ent. Soc. So. Africa **14**(2):77; Bregetova, 1951, Parazitol. sbornik **13**:111–19 (*partim*); Strandtmann, 1951, Jour. Parasitol. **37**(2):129; Zumpt and Till, 1955, Jour. Ent. Soc. So. Africa **18**(1):61, 82 (*partim*). Type by monotypy, *Sternostoma cryptorhynchum* Berlese and Trouessart.

Sternostomum Trouessart, 1895, Rev. Sci. Nat. Appliq., **42**(9):392–94 (*pro Sternostoma* Berl. and Trouessart); Vitzthum, 1935, Jour. Ornithol. **83**(4):568 (*partim*); Zumpt and Patterson, 1951, Jour. Ent. Soc. So. Africa **14**(2):77 (*partim*); Bregetova, 1951, Parazitol. sbornik **13**:111–19 (*partim*).

Diagnosis. Parasitic mites of the family *Rhinonyssidae* in the nasal cavities, tracheae, and lungs of birds. *Stigma* dorsal or lateral, without peritreme. *Gnathosoma* ventrally located, only partially visible from above. *Digits of chelicerae* not over $\frac{1}{10}$ the length of chelicerae. *Sternal plate* and usually the *anal plate* present. One or two *dorsal plates. Claws* of tarsus I greatly reduced and modified.

Key to the Species of *Sternostoma* (Females)

1. A single dorsal plate, the podosomal, present, with posterior margin bearing a median convexity 2
   A podosomal and an opisthosomal plate present, the former lacking a median posterior lobe 5
2. Sternal plate about as wide as long. No alveoli present on unarmed portion of venter. Posterior median lobe of dorsal plate a prominent triangular projection ..... *minutus*
   Sternal plate much longer than broad. Alveoli either with or without setae present on unarmed portion of venter. Posterior median lobe of dorsal plate a shallow, rounded convexity 3

3. Anal plate egg-shaped, narrower anteriorly than posteriorly; unarmed portion of venter with six pairs of minute, pointed setae in prominent alveoli. Leg IV longer than I. *turdi*
   Anal plate broadly rounded anteriorly and not broader posteriorly; unarmed portion of venter with less than six pairs of setae. Leg IV not longer than I 4
4. Ventral opisthosomal setae spatulate; no setae on genito-ventral plate. Rod on tarsus I almost as long as setae. Anal plate broadly elliptical ..... *spatulatum*, n. sp.
   Ventral opisthosomal setae setiform; one pair setae on genito-ventral plate. Rod of tarsus I not over one half as long as setae. Anal plate pear-shaped, with the narrow end posterior ..... *technaui*
5. Tarsi II–IV each with six broadly spatulate setae arranged in two transverse rows. Leg I shorter than leg IV ..... *cryptorhynchum*
   Tarsi II–IV without broadly spatulate setae. Leg I as long as or longer than leg IV .. 6
6. Tarsus I with sensory rod almost as long as longest tarsal setae; opisthosomal plate wider than long; genito-ventral plate with a central cellular design. *strandtmanni*, n. sp.
   Tarsus I with sensory rods not over one third as long as longest setae; opisthosomal plate longer than wide 7
7. Tarsus I with only one long, attenuate seta; chelicerae about 130 μ long. . *tracheacolum*
   Tarsus I with three to four long, attenuate setae; chelicerae less than 110 μ long 8
8. Leg I almost twice as long as leg IV; tarsi II–IV without elongate setae; adanal alveoli anterior to anus ..... *hutsoni*, n. sp.
   Leg I not over 1.3 times as long as leg IV; tarsi II–IV with elongate setae; adanal alveoli posterior to anus ..... *boydi*

Sternostoma cryptorhynchum Berlese and Trouessart

(Female, plate 1)

Sternostoma cryptorhynchum Berlese and Trouessart, 1889, Bibl. Sci. Ouest Bul. **2**(2):128; Vitzthum, 1935, Jour. Ornithol. **83**(4):571; Bregetova, 1950, Dokl. Akad. Nauk. S.S.S.R. **71**(5):1,005; Strandtmann, 1951, Jour. Parasitol. **37**(2):139; Zumpt and Till, 1955, Jour. Ent. Soc. So. Africa **18**(1):84, 86.

Rhinonyssus cryptorhynchum Berl. *et* Trouess. de Castro, 1948, Arch. Inst. Biol. Sao Paulo **18**(13):257.

The original description of S. *cryptorhynchum* was inadequate for specific determination, and no illustrations were given. Dr. Marc André very kindly loaned the writer a slide of this species from the Trouessart collection, the specimens being from the type host *Passer domestica* L. The following redescription of the female, with plate 1, is derived from this source.

Idiosoma—540 μ long; 270 μ wide.

Dorsum—Podosomal plate 203 μ long, 155 μ wide, granular, acuminate anteriorly, with narrowly rounded, cephalic margin; posterior margin almost straight; a cellular design as illustrated; five pairs of alveoli bearing minute spinules. Opisthosomal plate 116 μ long, 98 μ wide, ovate, bearing submedian rows of five paired alveoli, the posterior of which have minute spinules. Stigmata normal for genus. Unarmed cuticula finely striated, without setae or alveoli.

Venter—Sternal plate elongate rectangular, 115 μ long, 68 μ wide, bearing three pairs of alveoli, each with a short seta. Genito-ventral plate not expanded, but broadly rounded posteriorly, 67 μ long, 60 μ wide, scarcely extending posterior to level of coxae IV; surface with indistinct linear pattern of striae; no genital setae. Anus terminal, without plate; a pair of alveoli on anterolateral margins. Unarmed opisthosoma with two pairs of alveoli bearing short, rodlike setae between anus and genito-ventral plate.

Legs—As illustrated, plate 1. Leg I, 268 μ long, shorter than leg IV. Coxae II and III each bearing two alveoli with vestigial setae, coxae I with two indistinct alveoli, and IV with one alveolus. As stated by Trouessart (1895), coxae I almost contiguous in front of gnathosoma. All legs bearing minute spinules arising from relatively large alveoli, more numerous ventrally than dorsally. Claws of tarsus I modified characteristically for the genus. Tarsus I as illustrated, bearing a subapical prominent rod, two elongate setae, two small apical setae, and several minute spinules. Tarsi II to IV each with six ventral, flattened, spatulate setae arranged in two transverse rows; also two to three attenuate setae and several spinules.

Gnathosoma—Plate 1, figure 6. Ventrally located. Palpal tarsus with four short, apical setae; four movable palpal segments total 50 μ long; fused coxal portion of gnathosoma 46 μ long. Chelicerae 57 μ long, inflated basally; digits minute, 4 to 5 μ long.

Sternostoma cryptorhynchum is separable from all other species of the genus in that tarsi II, III, and IV possess ventral, broadly spatulate setae. It is the only species of the genus known from a ploceid host.

Sternostoma strandtmanni new species

(Female, plates 2, 3)

Idiosoma—380 μ long, 243 μ wide. Gravid specimens measure up to 650 μ long, 540 μ wide.

Dorsum—Podosomal plate 216 μ long, 189 μ wide, granular, bluntly rounded anteriorly, widest at mid level; lateral margins almost parallel in posterior one half, with broadly rounded posterolateral angles and straight posterior margin; a cellular design as illustrated; eight pairs of minute alveoli. Opisthosomal plate structure as in podosomal plate; 135 μ long by 150 μ wide; irregularly rounded, bearing two to three pairs of minute alveoli. Stigmata circular, without peritremes, located near posterolateral angles of podosomal plate and above coxae III. Unarmed cuticula finely striated, without setae or alveoli.

Venter—Sternal plate oblong, slightly narrower anteriorly, 105 μ long, 74 μ wide; three pairs of alveoli without visible setae. Genito-ventral plate 117 μ long, 59 μ wide, slightly constricted at mid level, drop-shaped posteriorly, with broadly rounded caudal margin; surface with characteristic cellular design in the mid region as illustrated; no genital setae. Anal plate broadly egg-shaped, large, with a pair of adanal alveoli at mid level of anal opening, bearing minute setae. Unarmed opisthosoma with one pair of alveoli near posterolateral margins of genito-ventral plate, and two submedian pairs between that plate and the anal plate.

Legs—Anterior legs 275 μ long with coxae 67 μ wide; leg IV, 229 μ long with coxa 67 μ wide. Coxae I to III each with two alveoli, vestigial setae visible only in anterior alveoli of coxae II and III, none on coxa IV. All legs bearing several minute dorsal and ventral setae. Tarsus I bearing, apically, two relatively large, attenuate setae, an elongate sensory rod, and several minute setae as illustrated; these structures absent on tarsi II to IV except for minute setae. Caruncles and claws typical of genus.

Gnathosoma—Ventrally located with only distal tips visible dorsally. Palpi (plate 3, fig. 5) short, broad, with four movable segments; tarsus with three

small, short, apical setae; remaining segments with a few minute setae as illustrated. Chelicerae 81 μ long, moderately expanded basally to width of 14 μ, with distal half rodlike; fixed and movable digits minute.

Nymph

(Plate 3, figs. 6, 7)

Idiosoma—420 μ long, 270 μ wide. As large or larger than mature, nongravid female. No dorsal or ventral plates visible by standard or phase microscopy. Stigmata as in female. Anus ventral, subterminal.

Legs—Leg I, 183 μ long; leg IV, 205 μ long. All legs with reduced caruncles; claws of tarsus I greatly reduced, others of normal shape, but smaller than in female. Tarsus I bearing a long, subterminal rod and one or two attenuate setae. Setae of legs similar to those of female.

Gnathosoma—Similar to that of female.

Larva

Idiosoma—405 μ long, 216 μ wide. Palpi of gnathosoma with three movable segments; terminal segment with setae as in female. Three pairs of legs, all with reduced caruncles, but with well-developed tarsal claws. Tarsus I bearing a long, subterminal sensory rod and one or two attenuate setae.

Holotype female collected from the nasal cavity of *Agelaius tricolor* (Audubon), the tricolored red-wing, taken 4½ miles northeast of Buttonwillow, Kern County, California, January 26, 1954. (In the U. S. National Museum, No. 2266.) Forty-two females, two nymphs, and one larva, designated as paratypes, were collected from 11 tricolored red-wings from Kern County, California, in 1954 and 1955. Several additional specimens were taken from nasal cavities of two cowbirds, *Molothrus ater californicus* Dickey and Van Rossem, and one common red-wing, *Agelaius phaeniceus* subspecies, both taken in Kern County. All collections were made by G. A. Hutson and associates. Paratypes are in the collections of the U. S. National Museum, the University of California's Department of Entomology and Parasitology, Berkeley, and R. W. Strandtmann, Texas Technological College, Lubbock.

S. strandtmanni may be distinguished from the related *S. tracheacolum* by the subcircular opisthosomal plate, by the expanded genito-ventral plate, and by an elongate sensory rod, on tarsus I, which approaches the length of the attenuate seta. Although *S. tracheacolum* was originally recorded only from a fringillid host, both species are now known from icterids, which occur only in the western hemisphere.

The known single larva and two nymphs of *S. strandtmanni* are in poor condition. It is quite probable that dorsal or ventral plates might be demonstrated in the nymphal stages of good specimens.

Sternostoma hutsoni new species

(Female, plates 3, 4)

Idiosoma—625 μ long, 350 μ wide.

Dorsum—Podosomal plate 263 μ long, 223 μ wide; granular, narrowly rounded anteriorly, with lateral margins diverging to broadest width at posterior quarter of plate; posterolateral corners broadly rounded; posterior

margin almost straight, plate finely punctate, but also bearing a cellular design as illustrated, nine pairs of minute alveoli bearing rudimentary setae. Opisthosomal plate granular, relatively large and elongate, 196 μ long, 128 μ wide, bearing three pairs of alveoli with minute vestigial setae; surface with cellular pattern as illustrated (plate 4). Stigmata circular, without peritremes, located near lateral margins above posterior margin of coxae III. Unarmed cuticula finely striated, without setae or alveoli.

Venter—Sternal plate keg shaped, slightly narrowed anteriorly, 140 μ long, 95 μ wide, bearing three pairs of alveoli, without visible setae. Genitoventral plate 148 μ long, 88 μ wide anteriorly, tapering posteriorly, with a broadly rounded posterior margin; surface with a longitudinal, reticular pattern; no genital setae. Anal plate obscure, but appears to project from posterior of opisthosoma as a rounded lobe, bearing a pair of minute alveoli anterolateral to anal opening. Unarmed opisthosoma with two submedian pairs of alveoli.

Legs—Anterior legs relatively massive, broader and longer than other legs, 405 μ long with coxa 145 μ wide; leg IV, 230 μ long with coxa 91 μ wide. Coxae I to III each with two alveoli bearing vestigial setae; none on coxae IV. All legs bearing numerous minute dorsal and ventral setae in relatively prominent, circular setal sockets. Tarsus I bearing, apically, four relatively large, attenuate setae, a sensory rod approximately one third the length of the setae, and two or more sensory micro-rods as illustrated; tarsi II, III, and IV without enlarged setae. Caruncles and claws typical of genus.

Gnathosoma—Ventrally located with only distal tips visible dorsally. Palpi short, broad, with four visible segments bearing three stout, short setae and four smaller, vestigial setae on tarsus; one short seta ventrally on segment two, and three dorsally on segment three. Chelicerae broad basally, tapering distally; 108 μ long, 27 μ wide; movable and fixed digits minute.

Holotype female collected by G. A. Hutson from the nasal cavity of a male *Hylocichla ustulata ustulata* (Nuttall), the russet-backed thrush of the family Turdidae, captured 4½ miles northeast of Buttonwillow, Kern County, California, on May 4, 1954. (In U. S. National Museum, No. 2267.)

S. hutsoni is related morphologically to *S. boydi,* but it can be distinguished by the lack of enlarged setae on tarsi II, III, and IV, by the relatively large size of leg I as compared with leg IV, and by the larger opisthosomal plate and longer chelicerae. The host of *S. hutsoni* is unrelated to those from which *S. boydi* has been recorded.

Since only a single specimen of *S. hutsoni* has been found, the possibility that the thrush was an accidental host should be considered. If the hypothesis is valid, that two species of the same genus do not normally occupy the same ecological niche, then it seems possible that the thrush is not the normal host of *S. hutsoni,* since several specimens of the new species *Sternostoma spatulatum* were taken from the same host.

Sternostoma tracheacolum Lawrence

Sternostoma tracheacolum Lawrence, 1948, Jour. Parasitol. **34**(5):364.

The nasal mite *Sternostoma tracheacolum* Lawrence has never been recorded from North America. Thus it was with particular interest that collections were received of a species agreeing closely with Lawrence's

description of *S. tracheacolum*. These species were collected by A. Rudnick from the nasal cavity, trachea, and lungs of *Icterus bullocki*, at Kern County Park, California, on June 26, 1952, and by G. Hutson from nasal cavities of *Agelaius tricolor* taken near Lerdo, Kern County, California, on June 15, 1955.

Previous collections of this species have been recorded by Lawrence (1948), from the trachea of caged canaries in South Africa. Lawrence (*in litt.*) states that the species has also been found in canaries in South America. Bregetova (1950, 1951) records the species from *Hirundo rustica* and *Acrocephalus arundinaceus* taken at the delta of the Volga, U.S.S.R.

Through the generosity of Dr. R. F. Lawrence, specimens of *S. tracheacolum* were obtained from South Africa for comparison with the California material. Study of specimens from both sources, with both standard and phase microscopy, has demonstrated that they represent a single species, and, in addition, has revealed several marked discrepancies from the original description. A redescription of the species is given below, based on specimens from South Africa, with a comparison based on California material.

Female

Plate 5 and plate 6, fig. 1, *ex Icterus bullocki* from California; plate 6, figs. 2, 3, *ex* canary from South Africa.

Idiosoma—Gravid females, 580 to 905 μ long, 268 to 512 μ wide; nongravid females, 486 μ long, 258 to 295 μ wide.

Dorsum—Podosomal plate granular, 256 to 270 μ long, approximately 195 μ wide; broad posteriorly, narrowly acuminate anteriorly. Width of plate in California specimens up to 223 μ; plate bearing cellular design (plate 5) and with about six pairs of indistinct alveoli, in some of which minute setae are visible. Opisthosomal plate granular, 125 to 135 μ long, 81 μ wide, as compared with 147 to 159 μ long, 59 to 90 μ wide in California specimens; plate bearing several minute alveoli. Stigmata dorsal, circular, without peritremes. Two pairs of dorsal alveoli, each bearing a minute seta on unarmed cuticula of opisthosoma, visible on occasional specimens from California; none seen on African material.

Venter—Sternal plate a rounded rectangle, or keg shaped, 135 to 155 μ long, approximately 85 μ wide, with three pairs of alveoli. Genito-ventral plate about 150 μ long, 61 to 74 μ wide, slightly narrowed posteriorly with posterior extremity varying from blunt to narrowly rounded; surface sculptured with longitudinal cellular pattern. Anal plate terminal, rounded anteriorly; no alveoli or setae visible. Two pairs of opisthosomal alveoli visible on some California specimens, but not seen on African specimens.

Legs—With numerous minute setae arising from circular sockets. Tarsus I bearing, subapically, one long seta, three short rods, and a microspine; tarsal length varies somewhat even among series from Africa, as figured (plate 6). Claws of leg I greatly modified. Tarsi II to IV each with one delicate, attenuate seta. Leg I, 226 to 341 μ long, with coxae 100 to 130 μ wide. Leg IV, approximately same length, but coxae only 80 to 90 μ wide. No coxal setae visible, although indistinct alveoli are visible on some.

Gnathosoma—Ventrally located with only distal tips visible dorsally. Palpi short, with four movable segments. Chelicerae 125 to 130 μ long, rodlike

distally, 6 to 8 μ wide; flared basally, 35 to 38 μ wide; movable and fixed digits approximately 11 μ long.

S. tracheacolum is rather closely related to *S. strandtmanni,* as discussed under that species.

Sternostoma boydi Strandtmann

Sternostoma boydi Strandtmann, 1951, Jour. Parasitol. **37**(2):135–40.
Zumpt and Till, 1955, Jour. Ent. Soc. So. Africa **18**(1):86.

Strandtmann (1951) records this species from the type host, *Crocethia alba* (Pallas), taken at Galveston, Texas, and, in addition, from *Larus delawarensis* Ord, *L. atricilla* Linn., and *Arenaria interpres* (Linn.).

Through the courtesy of Dr. Strandtmann, the writer examined a paratype female and several other specimens of this species from Texas. These agree very well with the original description and figures. For comparative purposes, a few additions are made as follows:

Leg I, measured to tip of the caruncle, 458 μ as compared with 388 μ for leg IV. Tarsus I bearing three enlarged, subapical setae, a sensory rod less than half the length of the setae, and four minute, blunt microspines. Tarsi II to IV each bearing two to three relatively large subapical setae and, ventrally, two or more subapical, slightly spatulate setae reminiscent of those of *S. cryptorhynchum.* Total length of movable palpal segments, 71 to 88 μ, depending on their orientation; fused coxal bases, 54 μ long; chelicerae, 68 μ long with digits approximately 6 μ long. Strandtmann described a pair of posterior, minute setae on the podosomal plate; in addition to these, there are three pairs on the lateral margins of the plate, all rising from prominent alveoli.

The affinities of *S. boydi* are with the new species, *S. hutsoni,* on a morphological basis, as discussed under that species; however, the species occurs on aquatic birds of the Scolopacidae, Larinae, and Arenariinae, whereas *S. hutsoni* has been taken only from the thrush of the family Turdidae.

Sternostoma spatulatum new species

(Female, plates 6, 7)

Idiosoma—528 μ long, 388 μ wide.

Dorsum—Podosomal plate, 250 μ long, 266 μ wide; granular, very broadly rounded anteriorly, widest at level of posterior one third; posterior margin with very slight median convexity; surface with cellular design as illustrated (plate 7); five pairs of minute alveoli, at least some bearing minute setae. No opisthosomal plate. Stigmata lateral between coxae III and IV. No peritremes. Unarmed cuticula with five distinct pairs of alveoli in opisthosomal region.

Venter—Sternal plate with margins indistinct; a pair of short, blunt setae near anterior margin, and two similar but larger pairs arranged in diverging rows near lateral margins of the plate. Genito-ventral plate very faintly outlined, tongue shaped, 67 μ long, 49 μ wide. Anal plate elliptical, 85 μ long, 52 μ wide; anus located at distance of its own length from the anterior margin of the plate; adanal pair of setae short, rodlike, located behind mid level of anus; postanal seta of similar shape, and located im-

mediately posterior to anus. Unarmed opisthosoma bearing short, stout, spatulate setae arising from alveoli as follows: one pair just lateral to posterior end of genito-ventral plate; two pairs between the genito-ventral and anal plates; two pairs more laterally placed between anal plate and coxae IV.

Legs—Leg I, 336 μ long to tip of caruncle; caruncle, 61 μ long. Leg IV, 330 μ long to tip of caruncle; caruncle, 24 μ long. Coxae I, II, and III each with two short, stout spines; coxa IV with one similar spine. Legs sparsely furnished with spinose setae. Tarsus I with pair of short, apical spines and, subapically, two relatively long setae and a rod almost as long, three shorter rods, and two or more short, stout setae. Tarsi II, III, and IV each with three apical short spurs and two subapical, long setae in addition to more proximal short, spinose setae. Claws of tarsus I reduced and greatly modified, those of remaining legs well developed and typical claw shaped.

Gnathosoma—Ventrally located with only distal tips visible dorsally. Palpi short, broad, with four movable segments including a fused tibio-tarsus totaling 49 μ long; fused coxal bases 49 μ long. Palpal tibio-tarsus with two stout, apical spines and one larger, mediolateral spine in addition to small spinules. Chelicerae, 95 μ long, moderately expanded basally to width of 19 μ. Chelae, 9 μ long. Hypopharynx fimbriated, tapering to acute point.

Holotype female collected by G. A. Hutson from the nasal cavity of *Hylocichla ustulata ustulata* (Nuttall), captured 4½ miles northeast of Buttonwillow, Kern County, California, on May 4, 1954. (In U. S. National Museum, No. 2268.) Four paratype females were taken from the same host.

S. spatulatum is closely related to *S. turdi* Zumpt and Till. The new species may be distinguished by the presence of five pairs of short, spatulate, ventral opisthosomal setae, by an elliptical anal plate, and by shorter chelicerae with relatively long chelae. (Chelicerae on a paratype of *S. turdi* measured 135 μ long, with chelae 6 μ long.) Although both species occur on hosts of the family Turdidae, the hosts are quite distinct phylogenetically as well as in geographic distribution.

Sternostoma turdi Zumpt and Till

(Plate 8)

Sternostoma turdi Zumpt and Till, 1955, Jour. Ent. Soc. So. Africa **18**(1): 85.

The original description of this species is adequate for differentiation from previously described members of the genus. Since details of tarsi and of dorsal idiosoma which are considered of significance here were not given by Zumpt and Till, some amplification of their description is desirable. The following observations and plate 8 are based on study of two female specimens, one a paratype, which were kindly loaned by Zumpt and Till. Both specimens were collected in South Africa from *Turdus olivaceus* L.

Dorsum—The single dorsal, or podosomal, plate 280 to 310 μ long, 260 to 290 μ wide, bearing a cellular design as illustrated (plate 8), and, in addition, six or seven pairs of alveoli, at least some of which have minute setae; a pair of posterolateral spinules of larger size projecting beyond the plate margin; stigmata circular, dorsal, at level between coxae III and IV. Unarmed dorsal

opisthosoma bearing six pairs of distinct alveoli and three or more pairs of smaller, indistinct alveoli.

Venter—Anal plate shape not so clear cut on the two specimens at hand as on that shown in the original description; it is apparently a very delicate plate which is easily distorted in mounting.

Legs—Leg IV is longer than other legs, 458 μ to tip of caruncle; leg I, next in length, is 418 μ long. Claws of leg I typical of the genus, greatly reduced. Tarsus I bearing two sharply attenuate, apical setae, and subapically, two long setae, three short, pointed setae, three short, blunt rods, and three minute, blunt spinules. Tarsi II, III, and IV each bearing two long, subapical setae and a more delicate, apical seta in addition to two or more short setae of a kind typically occurring on other segments.

Gnathosoma—Subterminally located, bearing two pairs of ventral alveoli (plate 8); palpi apparently with five segments distal to fused coxal bases; tarsal segment minute, bearing three short, pointed setae; length of movable palpal section, 50 μ; length of fused coxal bases, 54 μ; chelicerae, 140 μ long, chelae, 6 μ long.

S. turdi appears to be rather closely related to *S. technaui,* from which it may be distinguished as discussed below. It is most closely related to *S. spatulatum* as discussed under that species.

Sternostoma technaui (Vitzthum)

(Plate 9)

Sternostomum technaui Vitzthum, 1935, Jour. Ornithol. **83**(4):569–71.
Rhinonyssus technaui (Vitzthum, 1935), de Castro, 1948, n. comb. Arch. Inst. Biol. Sao Paulo **18**(13):257.
Sternostoma technaui (Vitzthum, 1935), Strandtmann, 1951, Jour. Parasitol. **37**(2):139.

Through the courtesy of Dr. Wolfgang Engelhardt, two specimens of *S. technaui* were made available for study from Vitzthum's collection. These were both females with the host given as *Cinclus cinclus.*

Examination of the specimens with the aid of the phase microscope made evident numerous significant details of structure not described by Vitzthum, as well as several discrepancies in the original description and figures. The following redescription and plate 9 are based on this study.

Idiosoma—600 μ long, 353 μ wide.

Dorsum—Podosomal plate over 297 μ long, 256 μ wide, tapering anteriorly to narrowly rounded cephalic apex; the anterior end of both specimens is sharply deflected downward; a similar condition probably resulted in the superficial appearance of a broadly rounded anterior extremity as figured by Vitzthum. Podosomal plate with five pairs of alveoli and a typical surface reticulation of cellular design as in other members of the genus. No opisthosomal plate. Stigmata located dorsolaterally over coxae IV. No peritremes. Unarmed opisthosoma bearing four pairs of alveoli with no setae visible.

Venter—Sternal plate 91 μ long, 61 μ wide; narrower anteriorly than posteriorly, bearing three pairs of setae in posteriorly diverging rows; space between posterior pair twice as great as that between anterior pair. Genito-

ventral plate 105 μ long, 54 μ wide posteriorly, bearing central cellular pattern and pair of posterolateral marginal setae. Anal plate broadly rounded anteriorly, narrower posteriorly; anus posteriorly located; pair of adanal setae at mid level, but lateral to anus. Unarmed opisthosoma with three to four pairs of short setae and one pair of alveoli lateral to posterior tip of genito-ventral plate.

Legs—Leg I, 418 μ to tip of caruncle; coxa I, 88 μ wide Leg IV, 380 μ to tip of caruncle; coxa IV, 84 μ wide. Claws of tarsi typical of genus. Tarsus I bearing two small, apical setae, two relatively long, subapical setae, approximately 20 μ long, a blunt rod 9 to 10 μ long, and approximately five short, stout spinules in addition to several more proximal, short setae. Tarsi II to IV each with two to three relatively long, subapical setae, three short, apical spurs as in *S. spatulatum*, and several short, acutely pointed setae. Coxae I to III each with two and coxa IV with one short, acutely pointed setae in prominent alveoli.

Gnathosoma—Ventrally located; distal tips not visible dorsally on either specimen at hand. Palpi with four movable segments, including the fused tibio-tarsal section as a single movable segment. Palpus, 55 μ long, bearing, apically, two prominent but short, pointed spinules on tibial portion in addition to minute tubercles and at least one delicate seta. Gnathosomal base 50 to 55 μ long, bearing a pair of prominent ventral alveoli. Chelicerae over 85 μ long, attenuated apically, but up to 13 μ wide basally; chelae minute.

S. technaui is closely related to *S. turdi*, from which it may be distinguished by the presence of setae on the margin of the genito-ventral plate, by the larger size of the plate, by the shape of the anal plate as well as by the other characters given in the key to species. The related *S. spatulatum* bears no setae on the small genito-ventral plate, has spatulate ventral setae, and a sensory rod on tarsus I almost as long as the tarsal setae.

Sternostoma minutus (Bregetova)

Sternostomum minutus Bregetova, 1950, Dokl. Akad. Nauk. S.S.S.R. **71**(5): 1,005–08.

The writer has not seen specimens of this species, but the description readily distinguishes it from other members of the genus as given in the key to species (p. 474). The existence of a single dorsal plate led Bregetova to place it in the genus *Sternostomum*, but as pointed out in the discussion of genera in this paper, that is not a valid generic name. The description leaves the exact placement of this species in some doubt, however, and it is possible that it belongs in *Rhinonyssus*. The position of the gnathosoma is not described nor illustrated. No anal plate is shown. The sternal plate is shown in the figure to be about as broad as or broader than long, which is not typical of the genus *Sternostoma*. Although Bregetova states that the digits of the chelicera are minute, this term is not objective enough to exclude the species from *Rhinonyssus*. Pending clarification of these points, however, it seems best to place the species in *Sternostoma*.

The host of *S. minutus* is a plover, *Charadrius niaticula*, of the Charadriidae.

NOTE

Since submission of the present paper for publication, the author has seen two recent papers by Fain (1956*a*, 1956*b*) in which members of the genus *Sternostoma* are considered. Eleven new species of the genus are described from birds collected in and around Astrida, Ruanda-Urundi, Africa. The descriptions given are very brief and are not accompanied by figures, hence it is difficult to evaluate their status. They appear to be distinct species, however, with the possible exception of *S. lagonostictae* Fain which, from the diagnosis given, seems very close to *S. cryptorhynchum,* differing primarily in having shorter legs.

Fain's new species and host data are as follows:

1. *S. sturnicola* from *Lamprotornis purpuropterus* (Rupp) and *Buphagus africanus* L.

2. *S. nectarinia* from *Cinnyris cupreus septentrionalis* Vince, *Chalcomitra senegalensis aequatorialis* (Reichw.) and *Nectarinia purpureiventris* (Reichw.).

3. *S. thienponti* from *Dicrurus adsimilis* (Beckst.).

4. *S. dureni* from *Turdus olivaceus graueri* Neum., *Turdoides melanops sharpei* Reichw. and *Turdoides jardinii emini* Neum.

5. *S. cooremani* from *Merops apiaster* L.

6. *S. hirundinis* from *Psalidoprocne albiceps* Sclat. and *Hirundo smithi* Leach.

7. *S. lagonostictae* from *Lagonosticta rubricata congica* Sharpe.

8. *S. cuculorum* from *Cuculus solitarius* (Steph.), *Chrysococcyx caprius* Bodd. and *Clamator levaillanti* Swains.

9. *S. laniorum* from *Lanius collurio* L., *Lanius collaris humeralis* Stanl., *Lanius excubitorius bohmi* Reichw. and *Batis molitor puella* Reichw.

10. *S. colii* from *Colius striatus kiwuensis* Reichw.

11. *S. castroae* from *Macronyx croceus* Vieill.

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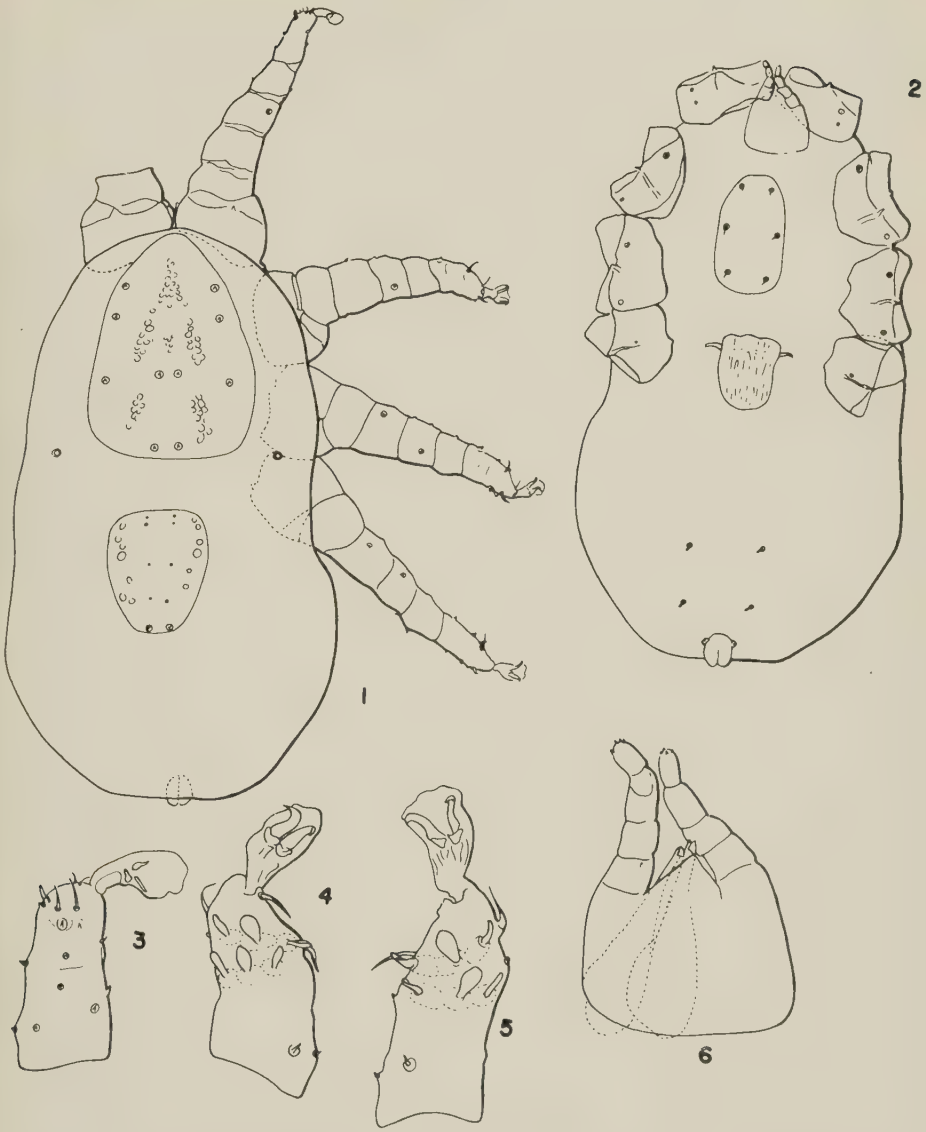


Plate 1. *Sternostoma cryptorhynchum* Berlese and Trouessart, female: 1, dorsum; 2, venter; 3, 4, and 5, tarsi I, III, and IV, respectively; 6, ventral view of gnathosoma.

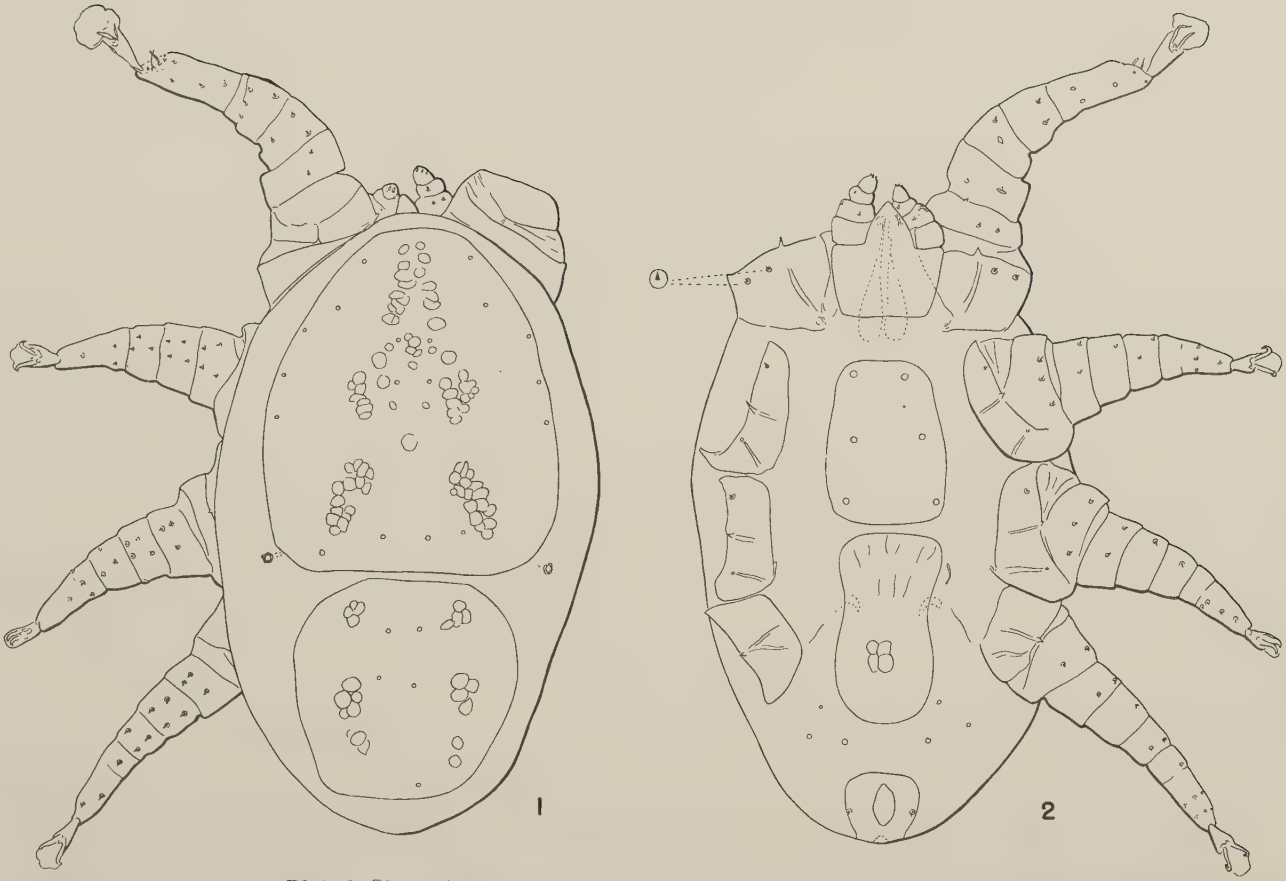


Plate 2. *Sternostoma strandtmanni* n. sp., female: 1, dorsum; 2, venter.

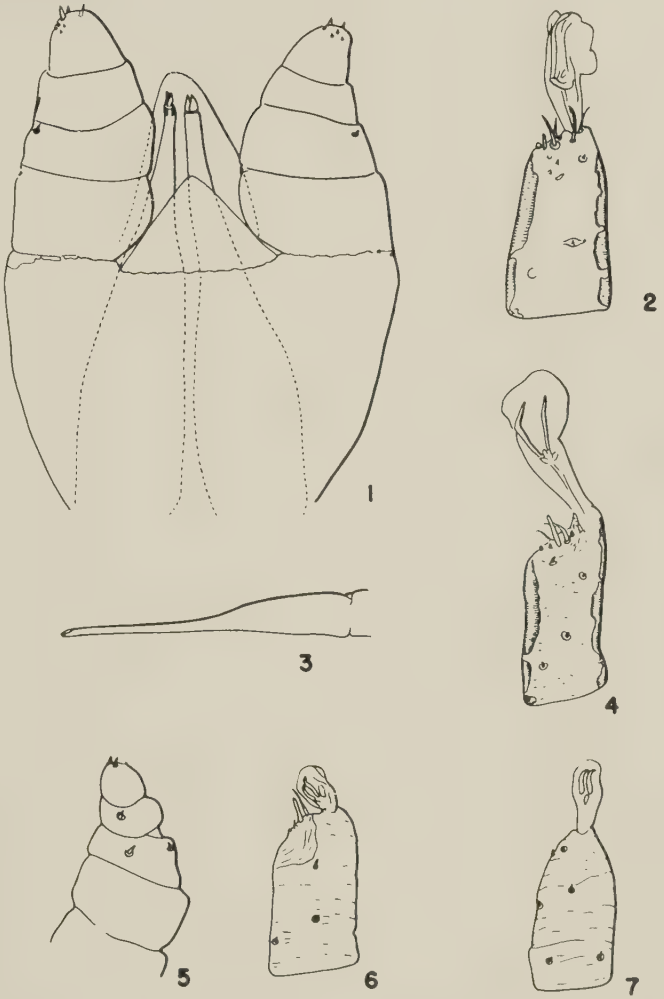


Plate 3. 1 and 2, *Sternostoma hutsoni* n. sp., female: (1) gnathosoma, ventral view; (2) tarsus I, dorsal view. 3 to 7, *Sternostoma strandtmanni* n. sp.: (3) chelicera, female; (4) tarsus I, female; (5) palpus, female, ventral view; (6) tarsus I, nymph; (7) tarsus IV, nymph.

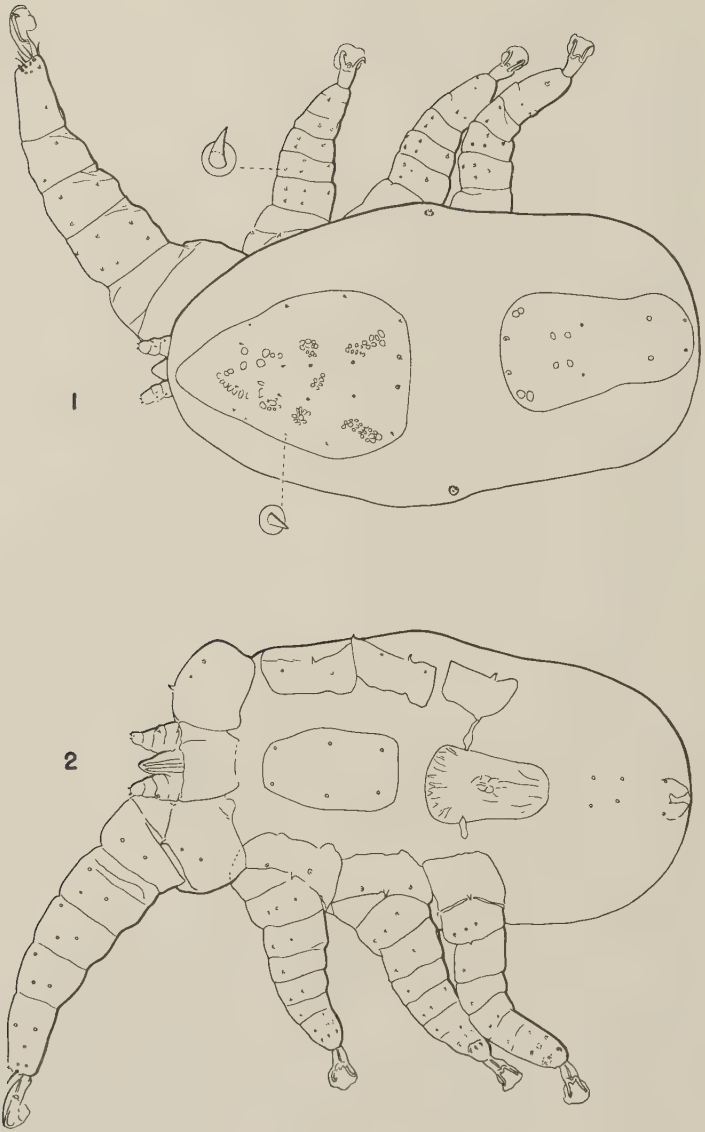


Plate 4. *Sternostoma hutsoni* n. sp., female: 1, dorsum; 2, venter.

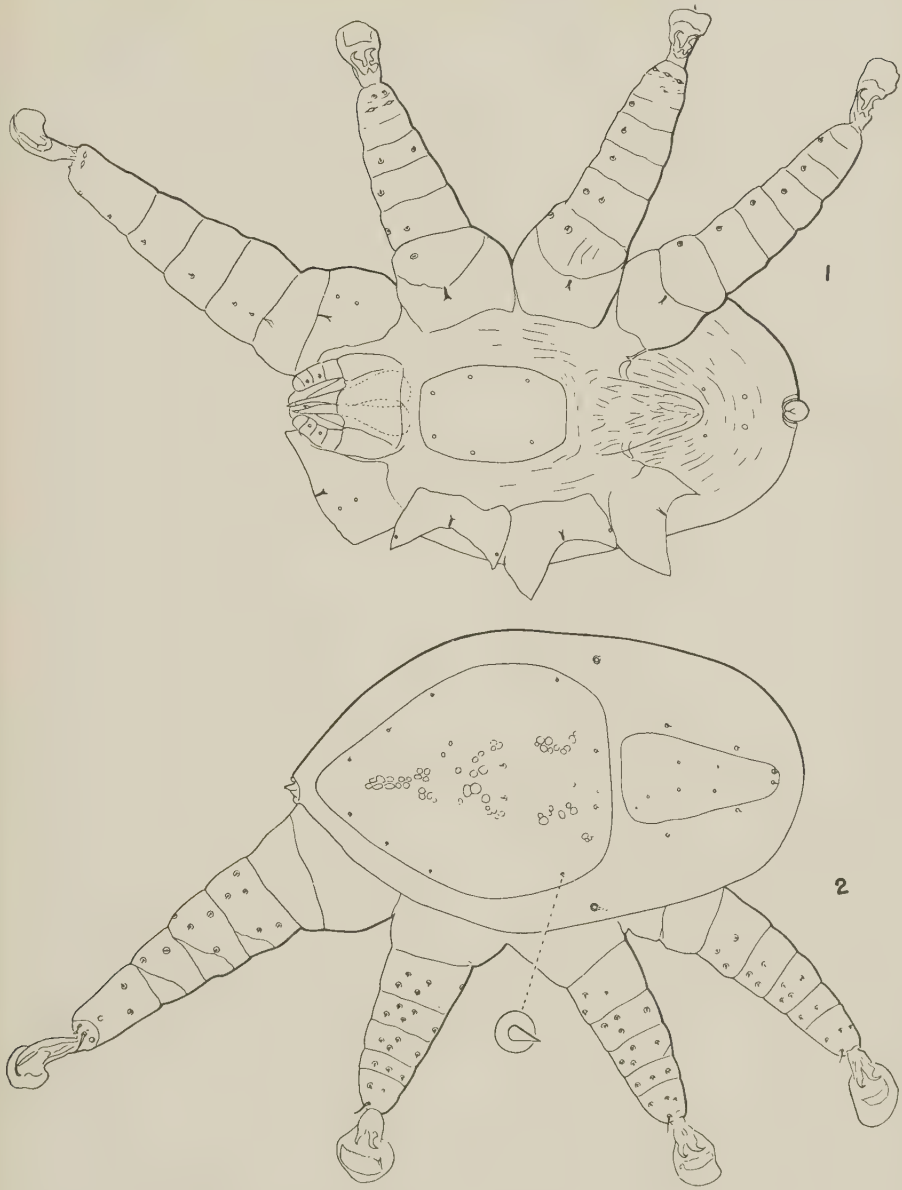


Plate 5. *Sternostoma tracheacolum* Lawrence, female ex *Icterus bullocki*, California: 1, venter; 2, dorsum.

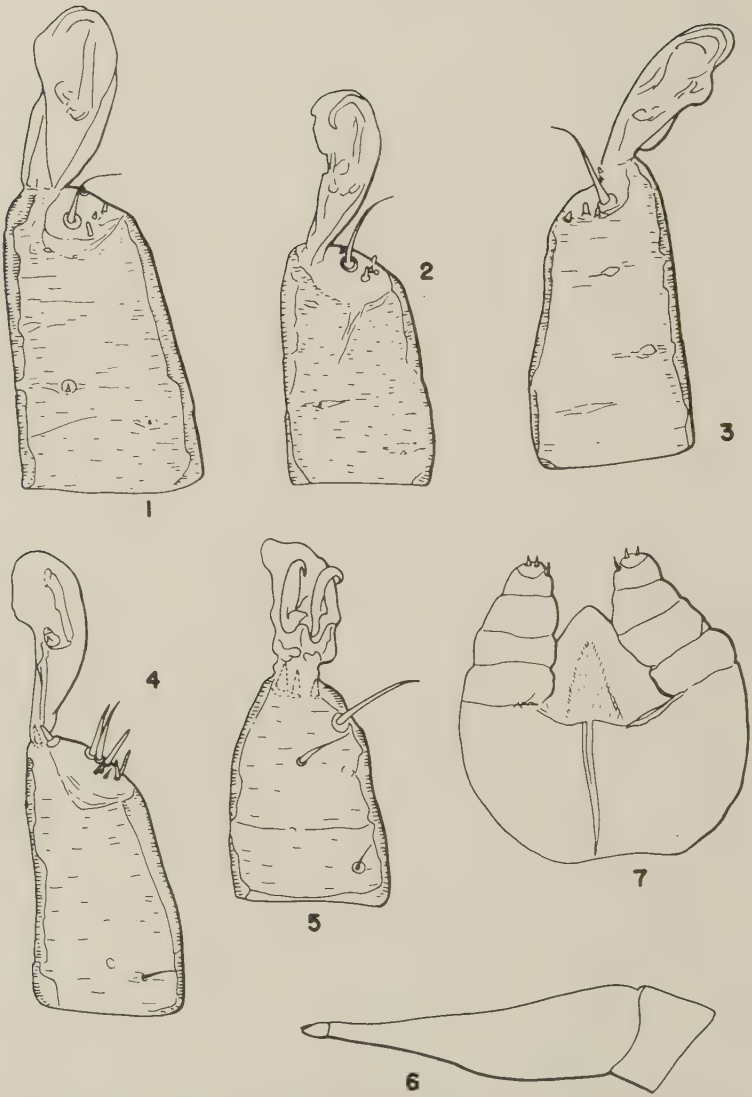


Plate 6. 1 to 3, *Sternostoma tracheacolum* Lawrence, tarsus I of female: (1) ex *Icterus bullocki*, California; (2) and (3) ex canary, South Africa. 4 to 7, *Sternostoma spatulatum* n. sp., female: (4) tarsus I; (5) tarsus IV; (6) chelicera; (7) gnathosoma, ventral view.

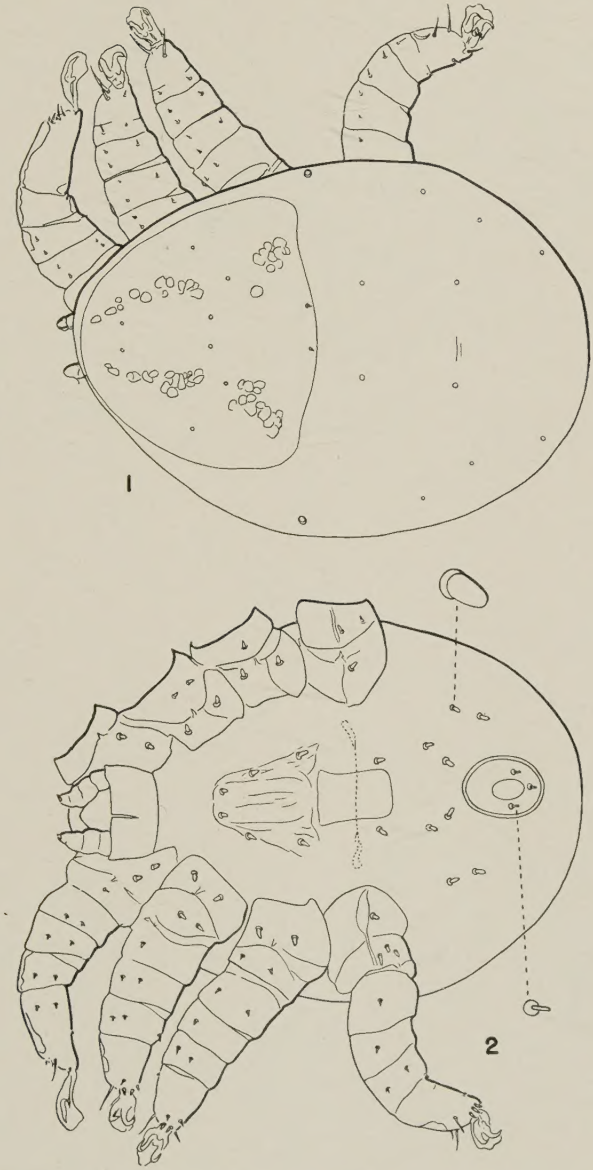
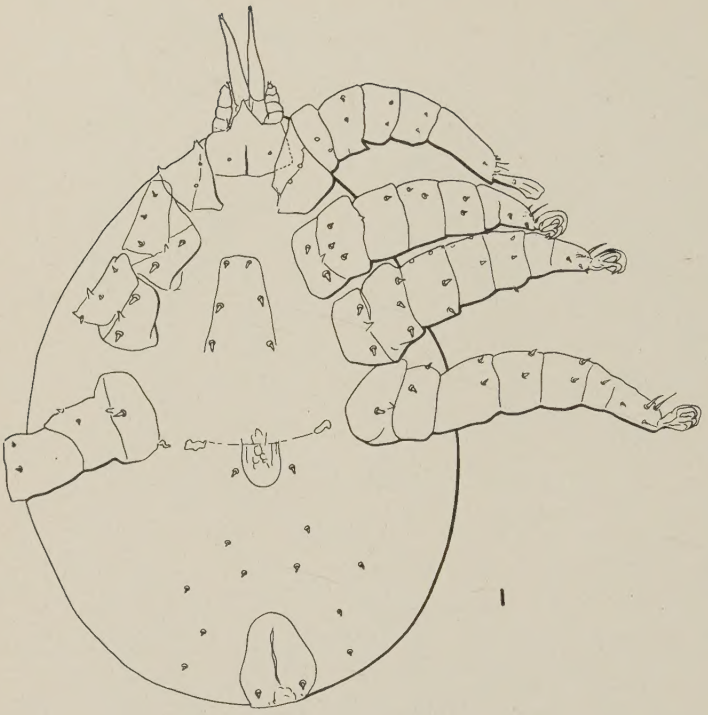
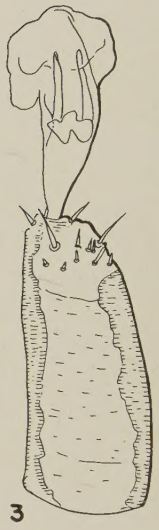
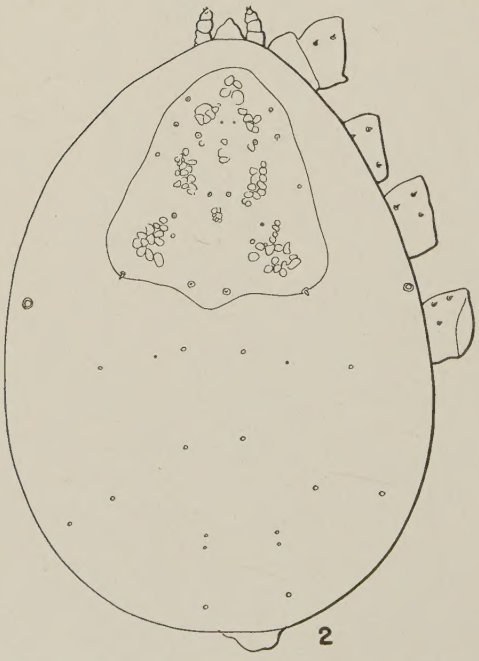


Plate 7. *Sternostoma spatulatum* n. sp., female: 1, dorsum; 2, venter.







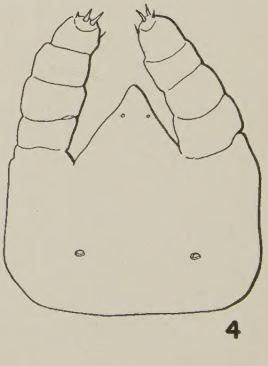
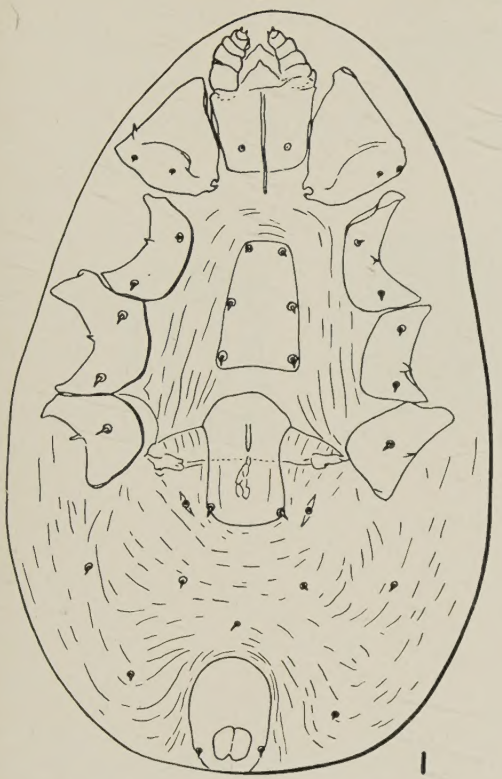
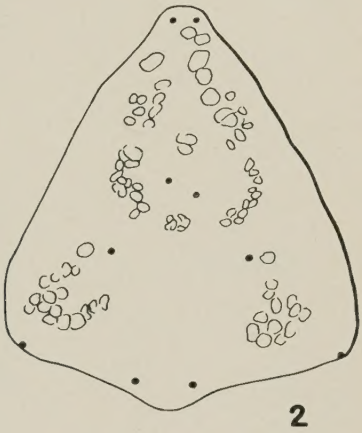


Plate 8. *Sternostoma turdi* Zumpt and Till, female: 1, venter; 2, dorsum; 3, tarsus I; 4, gnathosoma, ventral view.





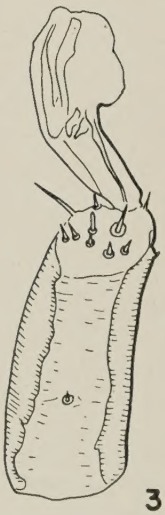


Plate 9. *Sternostoma technaui* (Vitzthum), female: 1, venter; 2, dorsal plate; 3, tarsus I; 4, gnathosoma, ventral view.